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PADGETT, M	
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Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.	Applicant(s)
08/781,920	Fukunaga et al
Examiner	**Group Art Unit**
M.L. Padgett	1762

—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

☒ Responsive to communication(s) filed on 6/6/01.

☐ This action is FINAL.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

☒ Claim(s) 23-75 is/are pending in the application.

Of the above claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 23-75 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claim(s) _____ are subject to restriction or election requirement

Application Papers

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119 (a)-(d).

☐ All ☐ Some* ☐ None of the:

☐ Certified copies of the priority documents have been received.

☐ Certified copies of the priority documents have been received in Application No. _____.

☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a))

*Certified copies not received: _____.

Attachment(s)

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____

☐ Interview Summary, PTO-413

☐ Notice of Reference(s) Cited, PTO-892

☐ Notice of Informal Patent Application, PTO-152

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Other _____

Office Action Summary

1. Claims 24, 41 & 50 still contain informal amendments in lines 4, 5 & 4, respectively, where "promoting" has been deleted.

2. Claims 31, 40, 49-58, 62 and 69-75 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 50 is vague and indefinite, as it is un clear which "said semiconductor film" is being referred to, the amorphous or the crystallized.

Use of undefined abbreviations or acronyms in claims is improper. What is "CPU" in new claims 71-75 intended to stand for? The term was found used in lists on p.38-39, but with no defining definition.

Claims 31, 40, 49 and 55 remain confusing and contradictory with respect to their independent claims, because one cannot promote <u>further</u> crystallization by melting what crystallization is already there because then there are no crystals to further crystallize, but one may then recrystallize the melted material. That one can crystallize from melted material and the degree of crystallization therefrom, is not at issue here, but the contradictions inherent in the particular word choices. The irradiating step treats "said crystallized semiconductor film .... to promote further crystallization...", ie. enlarging or enhancing already present crystal size, etc. So if you then claim to melt it , what's there is destroyed and then may be recrystallized, which is NOT what the independent claims are doing, ie further crystallizing. Applicants cite page 18 of the specification (response of 6/6/01), however the example being discussed there (starts on

p.17), does NOT first catalytically crystallize with heat, then use a laser, but imparts the crystallinity by using the combination of both heat and irradiation simultaneously, so neither further crystallization nor recrystallization are relevant to this disclosure! Furthermore, p.18 discusses the silicon film being "fused" by the laser light, which does not necessitate melting, but could include from melting to just softening, but the example does NOT melt anything that was previously crystallized as applicants are claiming. In embodiment 2 on p.20, where heating and irradiation are done sequentially, no fusing is discussed.

Claim 56 is ambiguous, because as phased in line 4, it is unclear as written if the heating comes from using a catalyst, or if one is using the catalyst while heating. Also, this ambiguity is contributed to by there being no statement as to what the catalyst is for.

3. Claims 56-58 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for crystallization processes by heating while using a catalyst, as in the preceding claims, does not reasonably provide enablement for that heating being caused by the catalyst. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to use the invention commensurate in scope with these claims. As specified in the abstract and Summary, applicant's invention is directed towards a crystallization process for amorphous Si that uses catalysts, but never discloses that the catalyst may effect heating. The examiner suspects this is an artifact of poor phrasing and is creating unintended and ambiguous scopes, hence claim 56-58 are NOT fully ENABLED, and contain NEW MATTER.

4. Claims 24-55 & 59-63 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

As noted above, the heating possibly caused by the catalyst as claimed in 56-58 is not taught in the original specification, hence is New Matter.

In independent claims 24, 32, 41 and 50, the claim of a second heating with an open ended temperature range is NEW MATTER, as is the claim that the catalyst in claims 24, 41 & 50 is "capable of crystallization of...", which would include the ability of the catalyst to cause crystallization all by its self, which is not supported by the teachings of the specification, and possibly not intended as the amendment deleting "promoting" was informal. Applicants' previous citation of p. 11, lines 6-10 which gives a maximum temperature range, to say (support) that they don't need one was NOT convincing. No disclosure of only a minimum required temperature was found, no open ended unlimitedly high temperatures, in fact temperature disclosure for the second heating step were either specific temperatures, such as 550° C for 4 hours in N_2 (embodiments 1, 2, 5 and 6), or well defined ranges of 450° - 750°C, but when the substrate is glass limited to a maximum of 600° C. Since the teachings in the specification stress the ability to use low temperature to crystallization due to the catalyst, the open ended temperature claim is contrary to the spirit of the disclosed invention since it includes high temperatures, as well as being unsupported. Applicants' arguments concerning use of

temperatures above 750°C is not supported by the specification, hence not convincing. Applicants have added claims 59-63 (amendment I of 11/22/99) without bothering to cite any support and have still not done so, and the examiner did not find any for this limitation that gives a functional condition for the temperature end point, instead of a numeral one, so they remain unsupported, hence new matter.

Claims 31, 40, 49 and 50 also appear to contain New Matter, because absolutely NO support for changing "fuses" to -- melts -- was found in the original specification. While fusing may include melting, it does NOT necessitate melting and what applicants intended by fused was unclear from the specification and context (which is why it was originally objected to), there was NOTHING in the text to lead one to believe melting had necessarily taken place. Quite the opposite in fact given the context of the claims, since one cannot improve or increase or promote **further** crystallization of a solid phase by making it liquid, which only might provide conditions to enable **re**crystallization, ie. making crystals go away can't increase, etc., those same crystals, just make different or new ones. That one possible definition of fused may require that the substrate have been melted, does NOT necessitate melting in the specification, because as shown by the applicant's dictionary citation, "united by heating" which need not include melting is also a definition and applicable to the specification's use of fused. Neither do the synonyms listed therein. Is this a translational discrepancy? Information to that effect might usefully resolve this issue. Also see discussion above in section 2.

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321© may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

6. Claims 24-75 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohtani et al (5,543,352) in view of Zhang et al (5,529,937) or visa versa, optionally in view of Liu et al (826) or Zhang et al (291).

Claims 24-75 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-20 of U.S. Patent No. 5,543,352 to Ohtani et al in view of Zhang et al (937), optionally in view of Liu et al (826) or Zhang et al (291).

Note that if all the NEW MATTER was removed form the claims the certified translation of JP. Ap. No. 6-225851 would be effective.

Ohtani et al claim (hence teaches) all aspects of applicant's claims, except the second thermal heating step; the formation of a transistor with channels (applicants' claims 41-49), but that is taught in example 3 on col.10, lines 38-48; the claimed melting (previous fusing) step whose meaning is not particularly clear or supported, but may be considered covered by teachings of light or laser light used in the same fashion; and the newly claimed patterning to form semiconductor islands (applicants' claims 50-55), but such is suggested by example 4 called 5 on col.11, lines 54-65. The specification of Ohtani et al (ie. for the 103 rejection) explicitly teaches the use of excimer lasers , which are inherently pulsed lasers, in a nitrogen atmosphere for use in the laser irradiation step of the crystallization, hence covering that aspect of claim 56. See col. 7, lines 10-15 in Ex. 1; col. 8, lines 1-8 in Ex. 2; col. 13, lines 16-28 in Ex. 5 and col. 15, lines 1-8 in Ex. 6 for use of various excimer lasers (KrF and XeCl) as claimed. It is further noted that Ex. 3 on col. 10, lines 38-45; Ex. 4 (called 5) in col. 12, lines 55-60; Ex. 5 in col. 14, lines 40-42 and Ex. 6 on col. 16, lines 5-8 teach annealing the final TFT devices produced in a hydrogen atmosphere, under conditions and circumstances as taught in applicant's specification.

The patent Zhang et al ('937) teaches and claims a very similar process with many overlapping steps, however it also teaches heating of the silicon film before, during and possibly after the irradiation step. Particularly see, claim 56, or col. 8, lines 12-23, or col. 15, lines 18-51 and Figure 5, where 3 periods of heating are discussed in relationship to the light irradiation step, such that the third step with 200-500°C corresponds to applicants' claimed second heating, with overlapping temperature ranges. The irradiation step in Zhang et al (937) may use either IR or

laser light to promote further crystallization (col. 7, lines 60-67; col. 9, lines 46-59; col. 12, lines 20-24), but the specific type of laser used at that step is not specified, however later laser anneal steps (after doping) applied to the Si film use excimer lasers (ie. pulsed), hence it would have been obvious to one of ordinary skill in the art to use the same types of lasers in the early step or in Ohtani et al's laser irradiating claims, because in both instances lasers are used to effect the crystallization of the silicon film in analogous fashions. See col 10, lines 42-51 and col. 16, lines 49-58 for KrF lasers and parameters used for annealing the Si film. Zhang et al (937)'s claims, such as 12, appear to be after or possibly during the irradiation, but have unclear temporal language. It would have been obvious to one of ordinary skill in the art to apply such heating in the Ohtani et al reference due to the similarities of the processes and taught benefit of reducing defects and dangling bonds. Zhang et al particularly teaches the use of nitrogen in the initial heating to crystallize and after irradiation H_2 ambient instead of N_2 as claimed by applicant's present claims 25, 33, 42 and 51 in order to neutralize dangling bonds (col. 7, lines 52-59; col. 8, lines 19-30; col. 9, lines 15-59 and col. 11, lines 11-16, etc.), however inert atmospheres would also have been expected to be effective as they are conventionally used for annealing procedures, hence would have been expected to have been effective especially considering the initial use of N_2 when heating to crystallize. Alternatively, Zhang et al (291) or Liu et al (826) teaches the use of Ar or other inert atmospheres for Ni or Pd - catalyzed annealing procedures of Si films at temperatures within the presently claimed range, although slightly higher than the Zhang et al ('937) third temperatures (col. 4, lines 20-48 and Ex. 2). Liu et al thus provides cumulative

evidence that inert atmospheres, hence N_2 would have been expected to be effective for the annealing of Ohtani et al in view of Zhang et al (937) and Liu et al.

The use of H_2 gas when annealing after irradiation in Zhang et al (937) would have made a subsequent previously claimed H-anneal step further obvious in Ohtani et al due to the explicit teaching on the effects on any dangling bonds that may remain, but use of hydrogen at this point is no longer an issue.

Zhang et al (937) also teaches use of their products, as claimed, with patterning producing island like semiconductor regions (col. 13, lines 13-22), and for producing channel forming areas in transistor devices (col.13, lines 52-64 & col. 15, line 52 - col. 16, line 13), hence use of the analogous features in an Ohtani et al product for such would have been obvious. As semiconductor substrates typically have a multiplicity of features, forming a plurality would have been standard procedure, hence obvious.

As noted above, claims 25, 33, 42 and 57 differ by requiring their atmosphere to be N_2, however Zhang et al (291) shows that for annealing semiconductors using heat, that N_2 is known to be an inactive atmosphere, hence obvious in view of the annealing procedures of the primary references, which are also a heat treating α-Si to cause crystallization. In Zhang et al (291) see abstract and claims, especially 1-10.

In Zhang et al (937) for further relevant teaching see abstract; Fig. 1 (etc); col. 4, lines 1-32 and 59 - col. 5, line 20 and 58 - col. 6, line 52, noting both thermal and radiation treatment appear to be taught to convert the amorphous area entirely to crystalline with col. 5, lines 5-10,

discussing heating to 600°C in conjunction with using laser light. Particularly see, col. 9, lines 15-45 for α-Si with Ni to promote crystallization where first heating at 550°C in N_2 or Ar for 4 hrs is taught, then lines 46-59 where laser light is taught to "further promote" crystallization, which is consistent with applicant's claimed limitations. Lines 55-59 discuss the effect on dangling bonds and reduction of defects. Col. 9, lines 60-67 give the next step which includes heating of the entire substrate from 300°- 550°C, hence will also inherently fulfill the claimed thermal annealing which can also be a post-treatment step. Furthermore, in the making of devices, after ion implanting (claim 10, lines 20-41), laser annealing is preformed again (col. 10, lines 42-67) and then it is taught that "it is important that dangling bonds caused in the process of light annealing....are neutralized by heating them at a temperature of from 250° to 400°C in the atmosphere of hydrogen in a later process" (col. 11, lines 12-16), hence cumulatively showing this concept. Note that Zhang's process involves patterns after the annealing, which is consistent with the concepts of claims 41 and its dependents.

Assuming that CPU stands for central processing unit, ie a computer, such devices are full of semiconductor devices containing basic structures as claimed here, hence it would have been obvious to one of ordinary skill to use such devices as made by the processes discussed here for their typical purposes.

7. Claims 50-51, 53-55, 69 & 74 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mitanaga et al P.N. 5,808,321 (supplied by applicant in the IDS 1/4/99).

Mitanaga teaches using impurities metals (In, Sn, Sb, Ge, Tl, Pb, Bi, Z, plus various the group III, IV and IV elements, column 3, lines 1-49) as catalyst for crystallization of amorphous Si. Col. 4, lines 15-57 mention sputtering, vapor depositions and ion implanting gas techniques for deposit of the catalyst. Embodiment 1, especially on col. 10, line 16 - col. 11, line 38 give the example of In, first heat treated in H_2 at 550°C, then lamp or laser treated to promote crystallization. Then follows a silicon oxide formation, followed by a heat treatment, the repeat of the lamp heating which further improves the crystal properties. The after a number of steps (col. 12, lines 33-43) a hydrogen anneal is performed on the entire substrate. Atmosphere and temperature are not given for the repeat treatment, however unless otherwise specified, one of ordinary skill in the art would assume that an atmosphere inert to the surface was used, making N_2 obvious. As the surface is heating due to light absorption, temperature above 450°C and consistent with previously taught anneal temperature would have been expected. The second embodiment shows that an analogous semiconductor film may be patterned and undergo island formation (col. 14, lines 3-16 & fig. 3), formation of a plurality of such features on a semiconductor substrate would have been obvious as a standard production procedure as discussed above. See CPU discussions above.

8. The disclosure is objected to because of the following informalities: for containing undefined abbreviations, ie. see p.38 and CPU.

Appropriate correction is required.

9. Applicant's arguments filed 6/6/01 and discussed above have been fully considered but they are not persuasive.

10. Any inquiry concerning this communication should be directed to M.L. Padgett at telephone number (703) 308-2336 on M-F from about 8 am- 4:30 pm, and Fax #(703)305-5408(official); 305-3599 (after final); and 305-6078 (unofficial).

M.L. Padgett
June 23, 2001

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